

NOTES ON THE PHACELIA MAGELLANICA COMPLEX IN  
THE PACIFIC NORTHWESTA. R. KRUCKEBERG<sup>1</sup>

The members of the *Phacelia magellanica* complex (Hydrophyllaceae) have defied satisfactory taxonomic delimitation ever since the traditional lineage of *P. circinata* Jacq. was found inadequate by E. L. Greene and later workers (Brand, 1913 and Macbride, 1917). Recently Cave and Constance (1942, 1944, 1947, and 1950) and Heckard (1954) have indicated the probable basis for the lack of clear-cut boundaries between the members of the group. After having made chromosome counts on a large number of field collections, it became evident to Cave and Constance that the taxa comprising this assemblage are elements of a polyploid complex. The intricate pattern of apparently reticulate phylogeny in the group has not as yet been transformed into a workable taxonomic scheme. A part of the taxonomic elucidation awaits the accumulation of additional cytological information on collections from areas in the west where phacelias have not been intensively collected. The Pacific Northwest is one such area. The present paper reports on field studies and chromosome counts of phacelias from northwestern United States and western Canada. A new diploid is described from Oregon and, for the first time, the existence of hexaploids in the complex is recorded.

## I. A NEW PHACELIA FROM SOUTHWESTERN OREGON

***Phacelia capitata*** sp. nov. Herba caespitosa perennis, 10–15 pedunculis tenuibus, quisque ex rosula laterali; pedunculi erecti simplices longi 20–25 cm.; folia rosulata spisse sericea angustato-lanceolata integra longa 2–3 cm., lata 0.2–0.4, sessilia; folia caulina reducta, longa 2–3 cm., lata 0.2–0.4 cm.; inflorescentia ex 2–3 cymis in unico racemo congesto subcapitato constans; racemus cymarum demum longus 2.0–2.5 cm., latus 3.0–3.5 cm.; pedicelli longi 1–3 cm., hispidi; calycis lobi angustato-oblongi longi 3 mm., lati 0.5–0.8 mm., margines pilis longis hispidi; superficies abaxialis pilis brevibus hirsuta; corolla alba rotato-campanulata longa 4–6 mm., lata 3–5 mm., lobi simplices obtuso-rotundati; appendiculae 1 mm. supra basin tubae corollae affixae; stamina et stylus exserta 5–7 mm., filamenta glabra vel paucis pilis sparsis; capsula immatura ovoidea longa 2–3 mm. tecta setis robustis longis 2–3 mm crebre; semina non visa.

Deeply taprooted caespitose perennial with 10–15 thin, wiry peduncles arising from as many rosulate tufts, the whole forming a broad and multicapital rosette, 25–30 cm. in diameter; stems erect, unbranched, 20–25 cm. tall, finely sericeous; silvery-gray herbage consisting of a hyaline-

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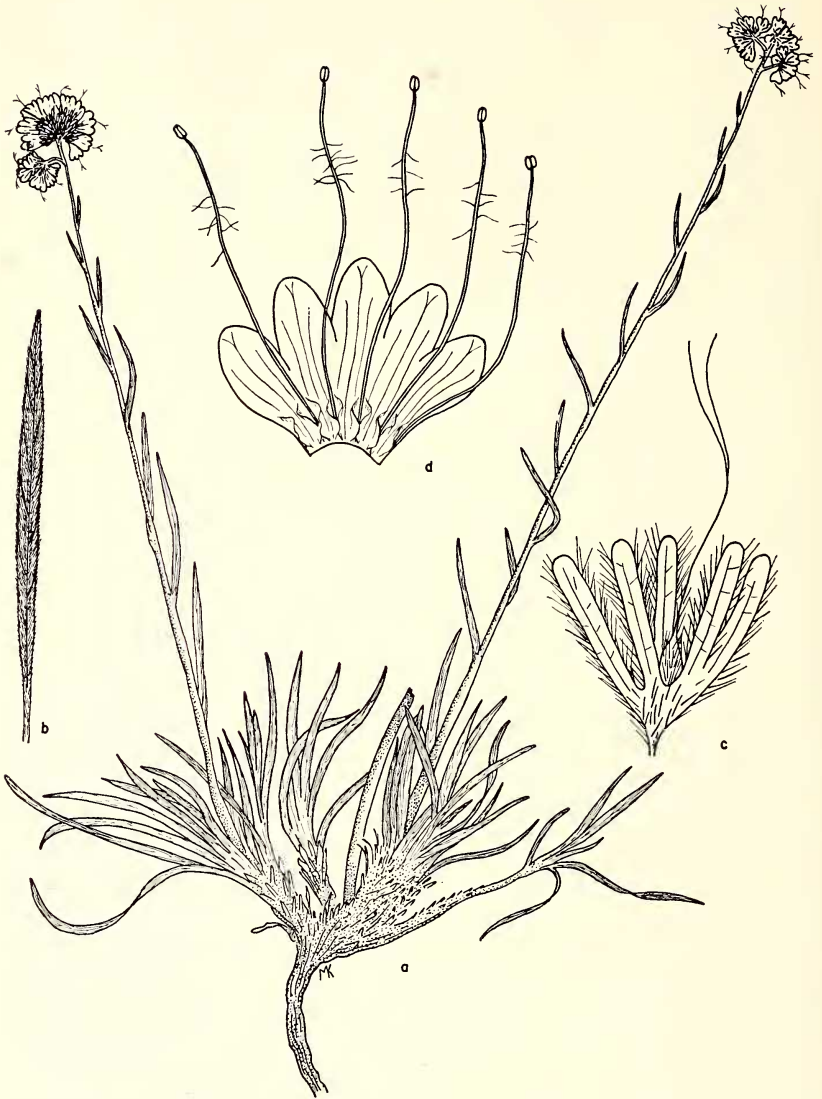


FIG. 1. *Phacelia capitata* sp. nov. a, habit; b, basal leaf; c, flowering calyx; d, expanded corolla. (Habit drawing  $\times 2/5$ ; leaf  $\times 4/5$ ; calyx and corolla  $\times 6$ .)

shiny pubescence of two sorts: appressed bristles on a background of thinly matted hairs; basal leaves linear-lanceolate, simple, entire, 2–3 cm. long, 0.2–0.4 cm. wide, apparently sessile; the 8–12 cauline leaves gradually but not wholly reduced, 0.7–2.0 cm. long, 0.2–0.4 cm. wide; in-

florescence consisting of 2–3 scorpioid cymes in a congested, subcapitate erect cluster, 2.0–2.5 cm. long and 3.0–3.5 cm. wide in early fruit, that is usually borne singly and terminally and subtended by much reduced cauline leaves; pedicels in early fruit 1–3 mm. long, hispid; calyx lobes linear-oblong, 3 mm. long, 0.5–0.8 mm. wide, two-thirds as long as corolla, margins long-hispid, abaxial surface short-hirsute; corolla white, rotate-campanulate, 4–6 mm. long, 3–5 mm. broad, the lobes entire, obtuse-rounded; appendages attached barely a millimeter above the base of the corolla tube, the free portions forming a long (3 mm.) and narrow “V” distally; stamens and style exerted 5–7 mm., the filaments glabrous or with a few scattered hairs about mid-length along the filament; immature capsule ovoid, 2–3 mm. long, densely clothed with stout bristles 2 mm. long; mature seeds not seen;  $n = 11$  (chromosome count from buds of type collection).

Type. On serpentine roadcut, 2 miles east of Bridge, above Coquille River and along State Highway 42, Coos County, Oregon, May 31, 1951, *A. R. Kruckeberg* 2703 (WTU No. 153940). Growing with *Cheilanthes siliquosa*, *Sisyrinchium bellum*, *Eriophyllum lanatum* and *Eriogonum nudum*. Topotypes:  $\frac{1}{8}$  mile north of State Highway 42, *Kruckeberg* 3313; “stony slope near Bridge, *M. E. Peck* 20324 (UC); *C. L. Hitchcock* s. n. (specimen from field transplant grown in greenhouse); 2.5 miles east of Bridge, *Constance* 3454 (seedlings also grown in greenhouse, *Heckard* S-295, UC). Other collections seen. OREGON. Serpentine bluff about 1 mile northerly from Myrtle Creek, *J. T. Howell* 28807 (CAS); 2 miles south of Myrtle Creek, *Eastwood and Howell* 1474 (CAS).

*Phacelia capitata* is distinguished from its nearest congeners by a number of features which are summarized in Table 1.

In addition to the features just tabulated, there are three others that give this new taxon specific distinction: (1) The large number of thin, wiry stems arising from the broadly cespitose rosettes; (2) the large number of cauline leaves; (3) the rarity of cymes below those of the terminal capitate cluster. Some of these diagnostic characters are illustrated in figure 1. The distinctness of *P. capitata* is further enhanced by its diploid chromosome complement. To date, only one other diploid collection of a *magellanica*-type *Phacelia* has been reported for Oregon (Cave and Constance, 1942). This, the wide-ranging, rank biennial, *P. heterophylla* Pursh, is a very different entity.

A search through herbarium material collected in southwestern Oregon which was available from several western herbaria has failed to disclose additional specimens that closely match those from the type locality of *P. capitata*. A specimen collected at Reston, Douglas County, by Professor Morton E. Peck (*Peck* 6035 WILLU) is suggestive of the new species, but differs in having tawny-green herbage, wider basal leaves and fewer cauline leaves. Collections from the Roseburg-Myrtle Creek area in Douglas County resemble *P. capitata*: *Peck* 6033, 6022 (WILLU);

TABLE 1. COMPARISON OF PHACELIA CAPITATA WITH NEAREST CONGENERS

Species	n number	Color and vesture of herbage	Length of leaves Basal	Cauline	Shape and lobing of leaves	Kind of inflorescence	Range and habitat
<i>capitata</i>	11	Silvery-gray, eglandular, appressed-hispid.	2-3 cm.	0.7-2 cm.	Linear-lanceolate, entire.	Capitate cluster of 2-3 cymes; tall, stiffly erect.	Dry, serpentine outcrops. Known only from type locality, Coos Co., Oregon.
<i>corymbosa</i>	11, 22	Tawny-ferruginous cast; glandular-hispid	2-7 cm.	2-3 cm.	Linear to lance-oblong, often with 1-2 pairs of leaflets at base of lamina.	Cymes in dense or open corymbs; stems 15-35 cm. tall, ascending.	Dry serpentine and peridotite outcrops. North Coast Ranges from California to southwest Oregon.
<i>leucophylla</i>	22	Silvery-gray, strigose-sericeous	11-15 cm.	8-11 cm.	Lanceolate, entire or rarely with 1-3 leaflets.	Paniculately disposed cymes, peduncle erect or ascending, often branching below terminal cymes.	Open sagebrush or yellow pine areas east of Cascade-Sierran axis from British Columbia south to California and east to Rocky Mountains.

*Eastwood* and *Howell* 1475 (CAS); *Constance* and *Rollins* 2966, and *Cusick* 4048 (both WS). Like the new species, the Roseburg-Myrtle Creek specimens have silvery-sericeous foliage and narrowly lanceolate cauline leaves. However, these five specimens do not have the capitate inflorescence or the thin wiry peduncles of *P. capitata*. A further difference is that the plant collected by *Constance* and *Rollins* proved to be tetraploid. *Constance*, at one time, annotated two of the four specimens in question as *P. leucophylla* Torr., thus placing them in a species, the usual distributional limits of which are east across the Cascade Range from Roseburg.

An exploratory search for additional stations of *P. capitata* in the region of the type locality as well as along the south fork of the Coquille River was unrewarding. More intensive botanizing on the serpentine areas of southern Coos County and western Douglas County as well as on similar ecologic sites along the northern boundaries of Curry and Josephine counties may yield new locations.

## II. THE HEXAPLOID PHACELIA LEPTOSEPALA RYDBERG

A widely accepted practice among field collectors and herbarium workers is to designate as either *Phacelia leucophylla* Torr. or *P. heterophylla* Pursh, those perennial phacelias of the *magellanica* complex that are collected from the crest of the Cascade Range eastward. This practice, at least, has the merit of correctly disposing of the majority of perennial phacelias collected in the Pacific Northwest, for these two taxa are certainly the two most widespread of the complex in the region. Ranging from arid sagebrush plains to the mid-montane pine belt, the two species present a variety of altitudinal and habitat forms. *Phacelia leucophylla* is tetraploid ( $n = 22$ ) in the several widely separated localities of the Pacific Northwest for which chromosomal numbers have been determined (Table 2 and *Cave* and *Constance*, loc. cit.). The equally distinctive and ubiquitous *P. heterophylla* is both diploid ( $n = 11$ ) and tetraploid ( $n = 22$ ) throughout the same general range. The more puzzling collections from the Pacific Northwest have been, however, the several high-montane forms of the *P. magellanica* group. Some of these truly appear to be altitudinal races of the two aforementioned taxa, but others are definitely distinct. These montane forms have gone under a variety of names. One of the names in the *P. magellanica* complex recognized as possibly valid by *Constance* (in *Abrams*, 1951) is *P. leptosepala* Rydberg. Justification for including within this taxon many of the subalpine collections of *Phacelia* from the Pacific Northwest now will be considered.

Because of the tawny-green herbage, plants considered by the author to be *P. leptosepala* often have been placed under *P. nemoralis* Greene ( $n = 11, 22$ ) a much taller, rank perennial of the Coast Ranges and bordering valleys having one to few stiffly erect stems clothed with strongly hispid-hirsute herbage. The montane plant in question, however, is ces-



FIG. 2. Meiotic chromosomes in pollen mother cells of certain members of the *Phacelia magellanica* complex. a, *P. capitata*,  $n = 11$  (Diak.), Kruckeberg 2803; b, *P. corymbosa*,  $n = 22$  (Diak.), Kruckeberg S-110; c, *P. frigida*,  $n = 22$  (Diak.), Kruckeberg s.n., July 1951; d, *P. frigida*,  $n = 33$  ( $M_I$ ) Kruckeberg 3781; e, *P. leptosepala*,  $n = 33$  (Diak.) Kruckeberg s.n., July 1951; f, *P. mutabilis*,  $n = 22$  ( $M_{II}$ ), Kruckeberg 3779.

pitose, with several assurgent to erect flowering stems. This discrepancy led Jones (1936) in his treatment of the flora of the Olympic Peninsula to remark: "the lowland plants are erect, 60-180 cm. tall, strongly hispid-hirsute and probably represent true *P. nemoralis*; the subalpine plants are decumbent at the base, less harshly pubescent, with whiter corollas, and may represent an undescribed species or variety." That Jones' conjecture about the "un-nemoraloid" character of these subalpine plants was a valid one may be judged from an examination of the following evidence.

During the past four years, numerous collections of bud samples for chromosome counts, as well as of living plants and herbarium specimens have provided information which permits a better understanding of this puzzling *Phacelia*. Very soon it was discovered that all tawny-leaved, cespitose plants collected in the Cascade and Olympic ranges of Wash-

TABLE 2. HAPLOID CHROMOSOME NUMBERS OF NORTHWEST PHACELIAS

	Haploid Chromosome Number	Number of Collections
<i>P. capitata</i> Kruckeberg	11*	3
<i>P. corymbosa</i> Jepson	(11)†, 22	2
<i>P. frigida</i> Greene	22, 33*	7, 3
<i>P. heterophylla</i> Pursh	11, (22)	1
<i>P. leptosepala</i> Rydberg	33*	18
<i>P. leucophylla</i> Torrey	22	14
<i>P. mutabilis</i> Greene	(11), 22	5
<i>P. nemoralis</i> Greene	(11), 22	2

\* Hitherto unreported chromosome numbers; other numbers confirm counts by Cave and Constance (*loc. cit.*).

† Haploid numbers in parentheses are from Cave and Constance (*loc. cit.*).

ington were hexaploid ( $n = 33$ , see fig. 2e and Table 2). Moreover, the chromosome number,  $n = 33$ , could be predicted with considerable accuracy in all subsequent collections that were "leptosepaloid" in character. This record of a hexaploid is the first for any *Phacelia*. The type of *P. leptosepala* from Vermilion Lake, British Columbia, as well as the three other specimens from British Columbia and Montana cited by Rydberg (1909) have been examined and prove to be good matches for the hexaploid material from Washington. Unfortunately, it has not yet been possible to obtain material for chromosome counts on the phacelias from the type locality.

Despite the apparently extensive range of *P. leptosepala* throughout the Pacific Northwest, it has not been collected at all frequently. Only 102 specimens out of over 800 sheets of the *P. magellanica* complex from the Pacific Northwest on loan from ten herbaria were judged by the author to be *P. leptosepala*. This scarcity is perhaps easily understood in view of the likelihood that, in its superficial resemblance to montane forms of *P. leucophylla* and *P. heterophylla*, it might be regarded as too common to be collected.

*Phacelia leptosepala* is perhaps more like *P. corymbosa* Jepson than any other of the possible congeners in the Northwest. Both are caespitose and have a ferruginous cast to the herbage. However, *P. corymbosa* is distinguished from *P. leptosepala* in the possession of a decidedly glandular pubescence. Moreover, it has been collected thus far as either a diploid or a tetraploid and may be separable from *P. leptosepala* on chromosome number. The two species are widely disjunct in distribution, *P. corymbosa* being confined rather closely to the serpentines of southwestern Oregon and northern California.

*Phacelia mutabilis* Greene ( $n = 11$  and  $n = 22$ ) and *P. leptosepala* may in exceptional specimens bear close resemblance to each other. In typical

material, however, *P. mutabilis*, with its weakly rosulate habit and few short and erect or assurgent stems is readily distinguishable from *P. leptosepala*. In mid-montane areas of the Cascade Range of southern Washington, *P. nemoralis* and *P. leptosepala* may intergrade. In the excellent series of phacelias collected by Suksdorf around Mount Adams (Mount Paddo) are certain specimens which cannot be placed readily in either *P. leptosepala* or *P. nemoralis*. The mid-montane populations in the Mount Adams-Skamania County area may truly represent altitudinal variants of *P. nemoralis*. Data on recent collections from this area are noteworthy. One from Spirit Lake (*Kruckeberg 3814*) was tetraploid; the plants are like those collected by Suksdorf, and may thus be regarded as samples of a mid-montane ecotype of *P. nemoralis*. Two collections were made on the nearby slopes of Mt. St. Helens, possibly four air-line miles away and 1000 feet higher; both were hexaploid and "good" *P. leptosepala*. When additional collections from this area have been examined cytologically, it should be possible to make a better evaluation of the phacelias in the territory of Suksdorf's most intensive collecting.

A number of characters distinguish *P. leucophylla*, typically an inhabitant of the sagebrush and yellow-pine belt, from *P. leptosepala*. Differences between them have been compiled in Table 3. Equally separable from *P. leptosepala* is the lavender-flowered high-montane, *P. leucophylla* var. *alpina* (Rydb.) Dundas. Although *P. alpina* Rydberg has been considered an infra-specific element of the biennial, *P. heterophylla* Pursh, because of its greater similarity to *P. leucophylla* in habit, leaf shape and vesture, and flower color, the author agrees with both Dundas (1933) and Macbride (1917) that it had best be considered an altitudinal variant of the latter species. Like *P. leucophylla*, var. *alpina* has whitish, sericeous herbage and mostly simple leaves, it may be expected to be sympatric with *P. leptosepala* in eastern British Columbia, Montana, and Idaho. Less tangible are the morphological differences between *P. leptosepala* and *P. frigida* Greene, the latter from subalpine regions in the southern Cascades of Oregon and in the Sierra Nevada of California. Typically, the more diminutive *P. frigida* is not obviously ferruginous-green, but merely sericeous or anthocyanous-gray in foliage. Though the range of *P. frigida* is mainly to the south of that for *P. leptosepala*, occasional specimens from more northerly areas of the Oregon Cascades cannot be clearly distinguished from dwarfed specimens of *P. leptosepala* collected in the northern Cascades or Olympics of Washington. Of two such specimens seen, one came from Nash Crater lava flows, Linn County (*A. W. Roach s.n.*, OSC) and the other from Three Fingered Jack, Jefferson County (*Constance 3444*, UC). The latter proved to be tetraploid (fide Constance, personal comm.). Thus in Oregon the ranges of the two may well overlap. Even with more typical material, *P. leptosepala* and *P. frigida* cannot be clearly separated on the basis of chromosome number. Seven collections of "good" *P. frigida* were determined by Cave and Constance



TABLE 3. MORPHOLOGICAL COMPARISON OF *P. LEPTOSEPALA* AND *P. LEUCOPHYLLA*

	<i>P. leptosepala</i>	<i>P. leucophylla</i>
HABIT	Cespitose, flowering stems usually procumbent to assurgent, with many basal subrosettes; caudex with numerous branches either bearing stems or sterile rosulate shoots. Herbage tawny-ferruginous throughout with mainly hirsute-hispid pubescence.	Flowering stems mainly erect from single or a few tufts of rosette leaves. Foliage silvery-canescens throughout, clothed with mixed strigose and sericeous pubescence.
STEMS	Several, decumbent to assurgent.	1-3, assurgent to stiffly erect.
BASAL LEAVES	9-11 cm. long, 7-10 mm. wide, occasionally entire or usually with 3-5 leaflets, petiole 4 cm. long; lanceolate in outline; long-hispid mainly on veins and margin of blade, sparingly hispidulose in intercostal areas; pungent bristles usually reddish brown.	11-15 cm. long, 1-1.5 cm. wide, commonly entire or rarely with 1-3 leaflets, petiole 4-10 cm. long; strigose mainly on margins and veins, densely sericeous on intercostal areas of lamina. Hairs of pubescence always glistening white.
CAULINE LEAVES	Several, somewhat reduced, compound, with 3 leaflets, 5-8 cm. long, hispid.	Numerous, scarcely reduced except just at base of cymes, mainly entire, 8-11 cm. long, strigose-sericeous.
INFLORESCENCE	Flowers at anthesis in dense, tightly coiled cymes in corymbs, the cymes 4-5 cm. long, tawny-hispid throughout.	Flowers at anthesis in virgately disposed cymes, the cymes 6-8 cm. long, straight except for tight coil of unopened flowers at tip, silvery strigose-hispid throughout.
CALYX	Lobes at anthesis linear-lanceolate, 9 by 1.0 mm.; long, stiff, pungent bristles mostly scattered on margin and on faint midrib; short soft hairs thinly scattered over lamina of lobe.	Lobes at anthesis ovate-lanceolate, 6 by 1.5 mm.; long stiff, pungent bristles on margin and scattered on abaxial surface, short-pilose hairs intermixed on lamina of lobe.
COROLLA	Tubular-campanulate, 7 mm. long, exerted.	Rotate-campanulate, 5 mm. long, 5 mm. broad.
STAMENS	Filaments pilose, 8-9 mm. long, exerted.	Filaments pilose, 10-12 mm. long, exerted.
PISTIL	Style 9 mm. long, bifid to $\frac{1}{2}$ its length, hispidulose at base; capsule hispid.	Style 12 mm. long, bifid to $\frac{1}{3}$ its length; hispidulose at base, capsule hispid.
SEED	Lance-ovate, 2-3 mm. long, brown, reticulate-pitted on all faces.	Ovate (to lance-ovate), 2.0-2.5 mm. long, brown to black, reticulate-pitted on all faces.
DISTRIBUTION	Montane and subalpine regions of Cascades and Olympic ranges of Washington; mountains of British Columbia and east along Canadian border to Rocky Mountains of British Columbia, Alberta, and Montana.	Open sagebrush or yellow-pine areas mainly east of the Cascade-Sierran axis from British Columbia south to California and east to Wyoming, Nebraska, and Colorado.

(personal comm.) as tetraploid. Yet of the four cytological samples of typical *P. frigida* taken by the author, only one was tetraploid; the others were hexaploid (i.e., like *P. leptosepala*). A fifth hexaploid collection of *P. frigida* was made late in 1955, from Mt. Hood, Oregon (*Kruckeberg 4000*). One hexaploid was from Crater Lake in Oregon and the other two were from Mt. Lassen and the central Sierra Nevada of California. This is an instance where incomplete cytological evidence could have been used to emphasize taxonomic discontinuity, but where additional chromosome numbers make such use of cytological data unwarranted.

Along the eastern flank of the Cascades of Washington, in areas of mid-montane altitudes, *P. leptosepala* and *P. leucophylla* can be expected to occur sympatrically. One such station is on Blewett Pass in Chelan County, where in 1952 the sympatry was positively confirmed by chromosome counts of both tetraploid *P. leucophylla* and hexaploid *P. leptosepala*. The following year a small population sample of ten plants was collected, together with buds, along a roadbank on the southeast-facing side of the pass. All plants appeared to be either good *P. leptosepala* or *P. leptosepala* with a suggestion of "leucophylloid" features. However, every one of the ten plants was hexaploid. It was hoped that the sampling would include both tetraploid and hexaploid plants and possible hybrids between the two different chromosome-numbered populations as well. Examinations of larger population samples would undoubtedly be more effective in judging whether or not these two taxa are interpollinating in this area of contact.

SPECIMENS OF PHACELIA LEPTOSEPALA EXAMINED:<sup>2</sup> OREGON. Wallowa County: Evergreen Forest Camp, upper Imnaha River, *Kruckeberg 3315*; upper Toomey Creek near mouth of Imnaha River, *Kruckeberg 2303 (RM)*; on granitic ridges above Douglas Lake, Wallowa Mountains, *Kruckeberg 2429*.

WASHINGTON. Chelan County: Jolly Mountain, *Easton s.n. (OSC)*; Falls Creek near Bryan Butte, *Ward 59 (WS)*; Ice Creek, *Morill 369*; Nelson Butte lookout, *Kelly 28 (WS)*; Stuart Pass, *St. John and Thayer 7308 (WS)*; Stevens Pass, *Otis 789 (WS)*. Clallam County: Mount Storm King, *Lawrence 351 (WS)*; Olympic Mountains, *Elmer 2829 (WS)*; Mount Angeles, *Kruckeberg 2782, J. W. Thompson 5519, Webster 1109*; ridge trail between Hurricane Ridge and Mount Angeles, *Kruckeberg 3807*; Seven Lakes Basin, *G. N. Jones 8249, 8267*. Garfield County: Bluffs above Tucannon River, near Willow Spring road, *Peters 388B (WS)*. Grays Harbor County: Mount Colonel Bob, *Thompson 7284*. Jefferson County: south slope of Mount Constance, *Rollins and Chambers 2649 (UC)*; Constance Ridge, *G. N. Jones 5803, Meyer 707 (WS)*; Lake Constance, *Thompson 7902*. Kittitas County: Teanaway-Turnpike Basin trail, *Kruckeberg 2614*; summit of Iron Peak Trail, Teanaway River drainage, *Kruckeberg 3287*; Fish Lake, *Kruckeberg 2954*; divide between Jungle and Johnson Creeks, toward Malcom Mountain, *Hitchcock 19131 (WS)*; near Naneum Meadows, *Kruckeberg 3247*; Blewett Pass region, *Grant, August 1929*; 1 mile south of Blewett Pass, *Constance and Beetle 2758*; head of Beverly Creek, *Thompson 5851*; Bald Mountain, *Thompson 14796 (WS)*. Lewis County: mica schist peak north of White Pass, *St. John 5631 (WS)*; Goat Rocks, *Thompson 15219*. Mason County:

<sup>2</sup> Institutional abbreviations follow Lanjouw and Stafleu, 1952. Specimens for which no herbarium designation is given are from the University of Washington, Seattle.

Skokomish Valley, *Kinkaid s.n.* (WS); Mount Elinor, *Freer 264*; Heart Lake, *Dickinson 26*. Okanogan County: Slate Peak trail, *Kruckeberg 3269*; Cash Creek near Harts Pass, *Kruckeberg 3271*; 2 miles below Mazama, *Kruckeberg 3272*. Pierce County: Chinook Pass Highway, 3 miles west of Ohanapech Junction, *Kruckeberg 3803*; Mount Rainier, *C. V. Piper 486*; *Grant, August 1925*; Cowlitz Glacier, *Pope, August 1904*; Mount Wow, *Warren 1606*; Nisqually River at Nisqually Glacier, *Heller 14762*; Carbon River, *Thompson 5446*; Nisqually Checking Station, *Abrams 9213*; below Carbon Glacier, *Eide s.n.* (WS); White River, *Warren 1456* (WS); north side Mount Rainier, *Jones 77* (WS). Skamania County: Mount St. Helens, *Thompson 12673*; Dog Creek, *Suksdorf 11483* (WS); Butterfly Lake, *Suksdorf 3509* (WS); north slope Mount St. Helens, *Gorman 5843* (WS); *Meyer 762* (WS); *St. John, et al. 7371* (WS). Snohomish County: Silverton, *Bonck 148* (WS). Whatcom County: Mount Herman, *Thompson 8049*; Mount Baker, *Turesson 22* (WS); Sourdough Mountain, *St. John 6836* (WS); Winchester Mountain, *St. John 8972*. Yakima County: Mount Aix, *Thompson 15023*; Mount Adams, *Henderson s.n.*; *Suksdorf 3442*; *3516*; *4355*; *6850*; *August 14, 1898* (all WS); Bald Mountain ridge, *St. John 7788* (WS); Gold Hill, *Pickett 1364* (WS).

IDAHO. Kootenai County: Near Fernan Lake shore, Coeur d' Alene, *Rust s.n.* (WS).

MONTANA. Beaverhead County: Sheep Creek, near Wisdom, *Berghuis 23*. Flat-head County: Camp Misery, Mount Aeneas, *Harvey 3325* (MONTU); Big Creek, *Edie 7* (MONTU); 2 miles southeast of Essex, *Brenckle and Shinnors 41-093* (RM); top of Columbian Mountain, *Rogers and Rogers 1155* (WS); China Wall, *Kirkwood 2292* (MONTU); head of Moose Creek, China Wall, *Kirkwood 2330* (MONTU). Gallatin County: Bridger Mountains, 3 miles north of Brackett Creek, *Hitchcock and Muhlick 12446* (WS); Spanish Basin, *Rydberg and Bessey 4850* (RM). Glacier National Park: Sperry Glacier, *Umbach 826* (NY); Museum (Clements) Glacier, *Elrod s.n.* (MONTU); trail from Logan Pass to Hidden Lake, *Nelson and Nelson 3158* (RM); Clements-Reynolds saddle, Logan Pass, *Ewan 18474* (UC); Glacier Park, *Osterhout 8106* (RM). Lake County: 6 miles southeast and high above McDonald Lake, Mission Range, *Hitchcock 18327*. Lincoln County: Mount McDougal, Kootenai Mountains, *Umbach 139* (NY). Powell County: 6 miles south of Big Prairie Ranger Station, *Hitchcock 18815*.

BRITISH COLUMBIA. Vermilion Lakes, *Edith M. Farr 1013* (TYPE! deposited at NY); Lardo, Selkirk Mountains, *Shaw 695* (NY); Sage Pass, *T. M. C. Taylor 8611* (UBC); Antimony Mountain, Lytton, *Tisdale s.n.* (UBC); Cowiche Lake, Cottonwood Creek (Nanaimo District), *Simpson and Simpson s.n.* (WS); Lake House, Skagit River, *Macoun 76757* (WS); "probably near Lumby" (*sic*), *Anderson s.n.* (WS); Cameron River valley, Vancouver Island, *Rosendahl 1996* (UC).

ALBERTA. Upper Waterton Lake near Bungalow Camp, *Nelson and Nelson 4727* (RM); Upper Carthew Lake, Waterton Lakes National Park, *Hitchcock and Martin 7906*; Prince of Wales Hotel, Waterton, *Breitung 15897* (UC); Cameron Lake, Waterton Lakes National Park, *Ewan 18497* (UC); Waterton Lakes Park, *Moss 3352* (UC).

VOUCHERS FOR CHROMOSOME COUNTS OF *P. LEPTOSEPALA* RYDB. The vouchers for chromosome counts of this species as well as for others cited in this paper are deposited in the herbarium of the University of Washington, Seattle. All 18 collections were  $n = 33$ . WASHINGTON. Chelan County: *Kruckeberg 3319* (population sample of ten plants at Blewett Pass). Clallam County: Mount Angeles, *Kruckeberg 3809*. Jefferson County: Anderson Pass, Olympic National Park, *Kruckeberg 4010*. Kittitas County: Upper Teanaway River, *Kruckeberg s.n.*, July, 1951; Wenatchee Mountains, *Kruckeberg 2963, 3050, 3219, 3238, 3253, 3257, 3287, 3945, 3953, 3965, 3968*. Lewis County: Egg Butte, Goat Rocks Primitive Area, *C. Leo Hitchcock s.n.* Pierce County: Rainier National Park, *Kruckeberg 3805*. Skamania County: Mount St. Helens, *Kruckeberg 3978, 3993*. Snohomish County: Stillaguamish-Sauk rivers basin, *Kruckeberg 3245, 3246*; Twin Lakes above Monte Cristo, *Kruckeberg 3948*. What-

com County: Mount Baker area, *Kruckeberg* 3797, 3801, 3802. Yakima County: Chinook Pass area, *Kruckeberg* 3260, 3804.

VOUCHERS FOR CHROMOSOME COUNTS OF OTHER TAXA

*Phacelia corymbosa* Jepson. (n = 11, 22). CALIFORNIA. Lake County: 4 miles northeast of Middletown, *Kruckeberg* S-214 (n = 22). OREGON. Josephine County: Illinois River road, *Kruckeberg* G-109 (n = 22).

*Phacelia frigida* Greene. (n = 22, 23). CALIFORNIA. Amador County: summit of Carson Spur, *Constance* 3090 (UC) (tetraploid). El Dorado County: Meeks Bay, Lake Tahoe, *Rollins* 3029 (UC) (tetraploid). Fresno County: Seldon Pass, *Kruckeberg* 3491 (n = 33). Lassen County: slopes of Mount Lassen, *Kruckeberg* 3710 (n = 33). Mono County: east slope of Mono Crater, *Constance* and *Bacigalupi* 3435 (UC) (tetraploid); one-fourth mile east of Sonora Pass, *Constance* and *Bacigalupi* 3437 (UC) (tetraploid). NEVADA. Washoe County: east side of Mount Rose Pass, *Constance* and *Mason* 2797 (UC) (n = 22). OREGON. Douglas County: North Junction, Crater Lake National Park, *Kruckeberg* 3781 (n = 33). Deschutes County: three miles south of Lava Lake, McKenzie Pass area, *Kruckeberg*, July 1950 (n = 22). Hood River County: Mount Hood, above Cloud Cap, *Kruckeberg* 4000 (n = 33). Klamath County: northeast rim of Crater Lake near Palisade Point, *Constance* 3362 (UC) (tetraploid).

*Phacelia heterophylla* Pursh. (n = 11, 22). OREGON. Jackson County: Neil Creek, *Kruckeberg* G-116 (n = 11).

*Phacelia leucophylla* Torr. (n = 22). OREGON. Deschutes County: Between Tumalo and Sisters, *Kruckeberg* 2071. Jackson County: Blair quarry near Ashland, *Kruckeberg* G-131. Wallowa County: Upper Imnaha River above Coverdale Guard Station, *Kruckeberg* G-229. Wasco County: 3 miles east of junction of Madras-Mt. Hood and Maupin-Mt. Hood highways, *Hitchcock* 19651. WASHINGTON. Kittitas County: 2 miles below junction of Hurley Creek and Liberty-Beehive roads, *Kruckeberg* 3240, 3254, 3255; lower Teanaway River valley, *Kruckeberg* (s.n.), July 1951; Mt. Lilian, *Kruckeberg* 3227; Swauk Creek, *Kruckeberg* 3317. Klickitat County (var. *Suksdorfii* Macbride): White Salmon, *Phillips* (s.n.) September 1952; between Blockhouse and Klickitat, *Kruckeberg* 3305; between Bingen and Lyle, *Kruckeberg* 3306. Yakima County: Satus Pass, *Kruckeberg* 3818.

*Phacelia mutabilis* Greene. (n = 11, 22). CALIFORNIA. Sierra County: Between Webber and Meadow Lakes, *Constance*, *Bacigalupi* and *Nasir* 3472 (tetraploid). OREGON. Deschutes County: 3 miles east of McKenzie Pass, *Constance* 3456 (tetraploid). Jackson County: Rogue River Natural Bridge, 2 miles southwest of Union Creek, *Kruckeberg* 2017 (n = 22). Wallowa County: Hat Point, *Kruckeberg* 2470 (n = 22). Crater Lake National Park: along Rim Drive, 3 miles above Park headquarters, *Kruckeberg* 3779 (n = 22).

*Phacelia nemoralis* Greene. (n = 11, 22). OREGON. Coos County: 2 miles east of Bridge, *Kruckeberg* 3314 (n = 22). WASHINGTON. Aberdeen area, *Kruckeberg* 3815, 3816, 3817. Skamania County: Spirit Lake, *Kruckeberg* 3814; Washougal River, *Kruckeberg*, July 1953 (greenhouse plant from seed collected by R. Ornduff (n = 22)).

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## THE DISTRIBUTION OF QUERCUS BOYNTONI

CORNELIUS H. MULLER

*Quercus boyntoni* Beadle was discovered near the summit of Lookout Mountain in Etowah County, Alabama, in 1900. Beadle (1901) named the plant after its collector and the species was recognized subsequently by Small (1913, 1933) and by Trelease (1924). Sargent (1918) reduced it to the status of a variety of *Q. stellata* Wang., stating that "the dwarf habit of this little oak is due probably to the exposed position and high altitude where it grows."

In 1942 there first came to my attention a series of specimens of a dwarf oak collected in 1934 in Angelina County, eastern Texas, by Effie Boon and by B. C. Tharp. The distinction between this and *Quercus stellata* was obvious, but the disposition of the Angelina County plant posed a problem, especially in the light of shrubby forms of other tree species known to occur in the prairie regions of Texas. Its segregation appeared unwise without a study of the plant in the field. Consequently, in my treatment of the oaks of Texas (1951) these specimens were included in *Q. stellata*. It is to this inclusion that the description of *Q. stellata* owes such characters as "small shrubs" and "leaves . . . obtriangular . . . bases cuneate . . . blades undulately . . . 2- to 4-lobed." The Boon collection cited from Angelina County under *Q. stellata* should have been identified as *Q. boyntoni*.